

Volume 6

1964-1965

SH  
11  
. A73  
A4  
V. 6

**ARLIS**

Alaska Resources

STATE OF ALASKA

Library & Information Services

Anchorage, Alaska

William A. Egan, Governor



ANNUAL REPORT OF PROGRESS, 1964 - 1965

FEDERAL AID IN FISH RESTORATION PROJECT F-5-R-6

SPORT FISH INVESTIGATIONS OF ALASKA

ALASKA DEPARTMENT OF FISH AND GAME  
Walter Kirkness, Commissioner

E. S. Marvich, Deputy Commissioner

Alex H. McRea, Director  
Sport Fish Division

Louis S. Bandirola, Coordinator

3 3755 000 46597 1

## INTRODUCTION

This report of progress consists of Job Segment Reports from the State of Alaska Federal Aid in Fish Restoration Project F-5-R-6, "Sport Fish Investigations of Alaska."

The project during this report period is composed of 23 separate studies designed to evaluate the various aspects of the State's recreational fishery resources. Of these, eight jobs are designed to pursue the cataloging and inventory of the numerous State waters in an attempt to index the potential recreational fisheries. Four jobs are designed for collection of specific sport fisheries creel census while the remainder of the jobs are more specific in nature. These include independent studies on king salmon, silver salmon, grayling, Dolly Varden, a statewide access evaluation program and an egg take program.

A report concerning the residual effects of toxaphene accumulates the findings of a three-year study. The report presented here terminates this segment and is a final report. The information gathered from the combined studies will provide the necessary background data for a better understanding of local management problems and will assist in the development of future investigational studies.

The subject matter contained within these reports is often fragmentary in nature. The findings may not be conclusive and the interpretations contained therein are subject to re-evaluation as the work progresses.

## JOB COMPLETION REPORT

## RESEARCH PROJECT SEGMENT

STATE: ALASKA Name: Sport Fish Investigations of Alaska.

Project No.: F-5-R-6 Title: Evaluation of the Fire Lake Hatchery Water Supply.

Job No.: 9-C-2

Period Covered: February 1, 1964, to January 31, 1965.

## ABSTRACT

Water temperatures at the Fire Lake Hatchery reached a maximum of 64° F. in July and a minimum of 36° F. in February and March 1964. The bypass valve remained open during sub-zero air temperatures to maintain suitable hatchery water temperatures and to prevent freezing of the pipelines. The dissolved oxygen concentration in the hatchery ranged from 4.4 ppm to 11.0 ppm. Dissolved oxygen in Upper Fire Lake was lowest at all depths in late spring. The pH ranged from 6.6 to 7.9 in the hatchery and 6.4 to 7.9 in Upper Fire Lake. Carbon dioxide and total alkalinity concentrations in the hatchery corresponded with those of the 15- and 20-foot depths in Upper Fire Lake during the year. The maximum recorded snow cover on Upper Fire Lake measured 10 inches and the maximum ice depth was 36 inches.

## RECOMMENDATIONS

It is recommended that this project be continued with emphasis placed on the evaluation of the existing data for the proper manipulation of the hatchery water supply system. Analysis of this data should yield information relevant to the hatchery's carrying capacity.

It is further recommended that an irrigation-type water flow meter be installed in the main water supply line to the hatchery. The 8-inch water line from the lake should be covered in some manner to minimize heat loss.

Experimental attempts should be made to increase the water temperature about 10° F. from about February 15 to April 15 of each year.

## OBJECTIVES

To evaluate the Fire Lake Hatchery water supply and to provide recommendations for improvements and procedures designed to fully utilize its potential.

## TECHNIQUES USED

Water temperatures were recorded on a Taylor recording thermograph during the year. The thermograph is a spring-wound device that measures the water temperature and simultaneously records it on a circular chart in seven-day periods.

Maximum-minimum outside air temperatures were taken and recorded throughout the report year from a thermometer mounted on the north wall of the hatchery.

Water samples were collected, analyzed and recorded at the intake tower in Upper Fire Lake and at the hatchery to determine variations between the two stations, observe any chemical or physical changes in the hatchery during egg and fish occupancy and to establish seasonal trends. Dissolved oxygen and pH tests were conducted on a Hach direct reading colorimeter. Total alkalinity and carbon dioxide concentrations were determined by the titrimetric method. Snow and ice cover and water temperatures were recorded on each sample date.

Aluminum trough aerators were placed in operation in May to alleviate the "gas-bubble" disease that occurs during the summer months.

It is theorized that in the summer the deeper waters of Upper Fire Lake become supersaturated with dissolved nitrogen. The aerators not only release the nitrogen to safe levels for trout but also add appreciable amounts of oxygen. The aerator is described in Volume IV, Alaska Department of Fish and Game Dingell-Johnson Report, Page 280.

## FINDINGS

The water supply for the Fire Lake Hatchery is obtained from Upper Fire Lake which is located approximately 34 feet above the level of the hatchery. Water samples were collected periodically from five depths at the intake tower on Upper Fire Lake. The samples were tested for dissolved oxygen, carbon dioxide, total alkalinity and pH. Water and air temperatures and snow and ice cover were recorded on each sample date.

Water temperatures, recorded at the various depths in Upper Fire Lake, are presented in Figure 1. Maximum temperatures at all depths occurred during the month of August. The surface water temperature reached a high of 59° F. during the same month.

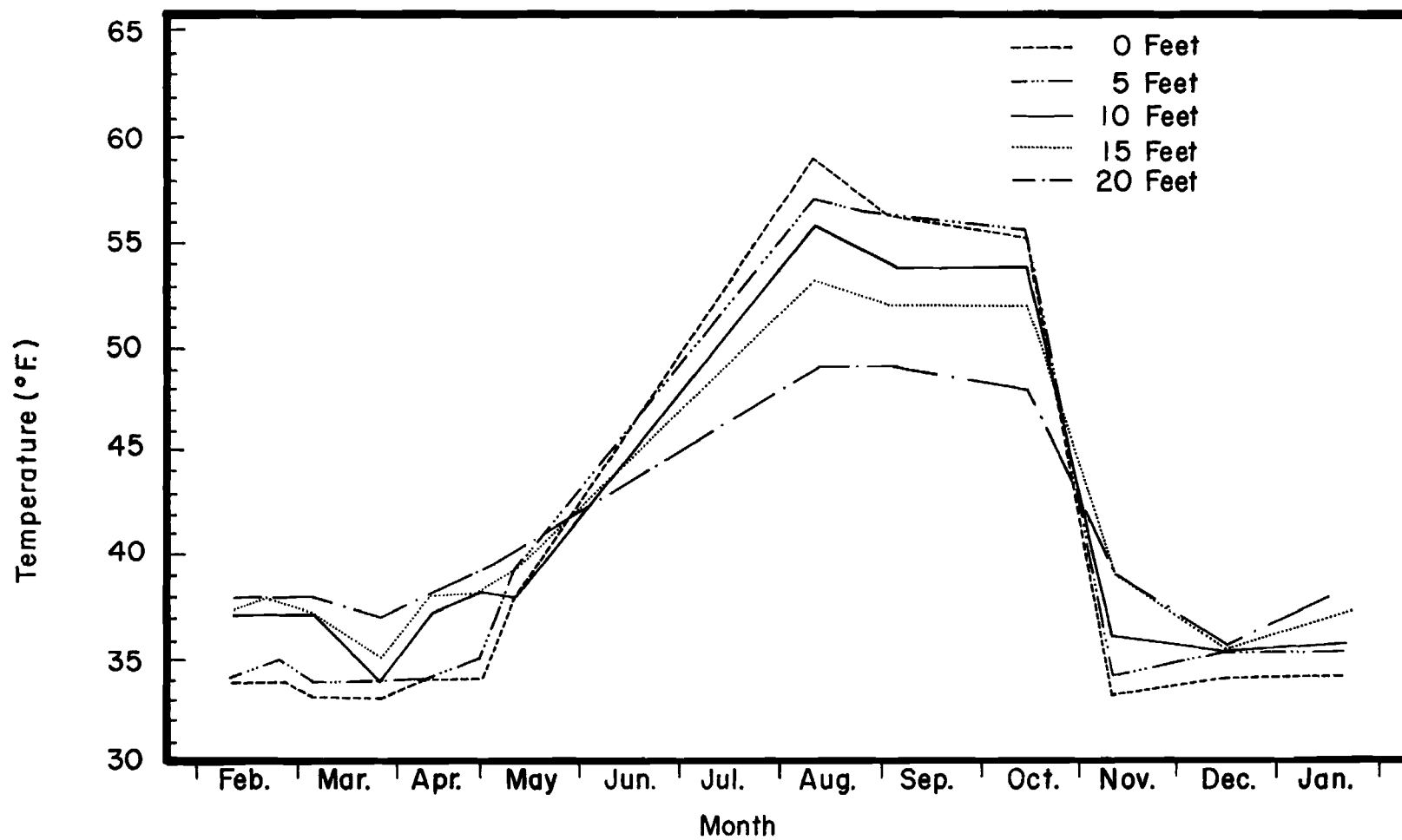


Figure 1. Monthly mean water temperature of Upper Fire Lake at 5 depths from February 1964 to January 1965.

TABLE 1. - Dissolved Oxygen Concentrations and pH from 5 Depths of Upper Fire Lake  
February 11, 1964 to January 18, 1965

Date	DEPTH IN FEET									
	0		5		10		15		20	
	DO	pH	DO	pH	DO	pH	DO	pH	DO	pH
Feb. 11	8.6	7.0	8.2	7.0	7.2	6.9	7.0	6.9	6.7	6.8
Feb. 25	8.2	7.0	7.9	7.0	6.9	7.0	6.5	6.9	5.6	6.8
Mar. 6	9.1	6.9	8.6	6.9	7.2	6.8	6.5	6.8	5.3	6.7
Mar. 27	7.3	6.4	6.9	6.7	6.8	6.7	6.1	6.8	5.1	6.7
Apr. 7	8.6	6.7	8.0	6.9	6.3	6.8	5.7	6.8	5.0	6.8
Apr. 28	9.4	7.0	9.9	7.1	8.8	7.0	7.3	6.8	4.2	6.7
May 7	9.7	6.9	9.9	7.0	9.5	7.0	8.5	6.8	7.5	6.8
Aug. 14	11.3	8.0	11.5	7.9	11.9	7.9	12.9	7.9	12.1	7.5
Sep. 4	11.1	8.1	11.1	8.1	11.9	8.1	12.4	8.2	11.7	7.5
Oct. 15	8.0	-	7.8	-	8.6	-	8.7	-	11.0	-
Dec. 17	11.0	-	-	-	-	-	-	-	-	-
Jan. 18	-	7.0	7.1	6.9	7.0	6.9	6.9	6.9	6.8	6.8

TABLE 2. - Carbon Dioxide and Total Alkalinity Concentrations from 5 Depths of Upper Fire Lake February 11, 1964 to September 4, 1964, Expressed in Parts Per Million

Date	DEPTH IN FEET									
	0		5		10		15		20	
	CO <sub>2</sub>	Alk.	CO <sub>2</sub>	Alk.	CO <sub>2</sub>	Alk.	CO <sub>2</sub>	Alk.	CO <sub>2</sub>	Alk.
Feb. 11	3	77	3	76	3	75	4	78	3	73
Feb. 25	3	77	3	75	3	74	3	74	2	72
Mar. 6	3	76	3	78	3	77	3	73	3	80
Mar. 27	5	-	2	-	3	-	5	-	6	-
Apr. 7	3	73	3	76	3	74	3	76	3	77
Apr. 28	2	65	3	81	3	78	3	75	5	77
May 7	2	62	2	70	2	79	3	79	3	74
Aug. 14	0	64	0	67	0	71	0	74	2	78
Sep. 4	0	69	0	70	0	65	0	67	1	74

Air temperatures were recorded on each water sample date at Upper Fire Lake.

The analysis of the dissolved oxygen data collected from five depths on Upper Fire Lake revealed that during the winter and spring of 1964 the concentrations gradually declined at the 15- and 20-foot depths (Table 1). During the spring turn-over, the lake rapidly took on oxygen and averaged about 10 ppm during the summer months. A high of 12.9 ppm occurred on August 14 at the 15-foot depth. Dissolved oxygen concentrations gradually diminished again after the fall over turn.

The high pH readings on Upper Fire Lake occurred at all depths in August and September, while the low readings were recorded at the 20-foot depth during March and April (Table 1).

The carbon dioxide concentrations at all test depths in the lake ranged from 0 to 6 ppm throughout the year (Table 2). The highest concentrations were recorded at the 20-foot level in March, while the lowest readings occurred in August and September at all test depths.

Total alkalinity tests from water samples taken at Upper Fire Lake reveal that fluctuation in concentration appears to bear little, if any, relationship to fluctuations in carbon dioxide levels (Table 2).

Snow depths on Upper Fire Lake fluctuated between each sample period because of new snowfall and melting or settling of the existing snow. The deepest snow depth was 10 inches in April.

As late as May 5 the ice cover on the lake measured 32 inches (Table 3). Ice breakup occurred on June 1. This is somewhat later than the normal breakup time of May 20-25. Ice formation began in mid-October and reached a maximum depth of 36 inches in March.

TABLE 3. - Air Temperatures, Snow and Ice Depths from Upper Fire Lake February 11, 1964 to January 31, 1965

<u>Date</u>	<u>Air Temperature</u>	<u>Snow Depth In Inches</u>	<u>Ice Depth In Inches</u>
Feb. 11	2	3	30
Feb. 25	34	4	32
Mar. 6	30	6	36
Mar. 27	35	10	35
Apr. 7	39	10	34
Apr. 28	38	1	31
May 7	48	0	-
Aug. 14	66	-	-

TABLE 3. (Cont.) - Air Temperatures, Snow and Ice Depths from Upper Fire Lake February 11, 1964 to January 31, 1965

<u>Date</u>	<u>Air Temperature</u>	<u>Snow Depth In Inches</u>	<u>Ice Depth In Inches</u>
Sep. 4	55	-	-
Oct. 26	-	-	1
Nov. 4	26	-	6.5
Nov. 19	36	16	8
Dec. 4	22	1	13
Dec. 17	18	12	16
Jan. 18	13	10	23

### Fire Lake Hatchery

The pipeline that supplies water to Fire Lake Hatchery from Upper Fire Lake is 8 inches in diameter, above ground and uninsulated. Water temperatures recorded immediately upon entering the hatchery troughs ranged from 36° F. to 64° F. throughout the year (Table 4). The manipulation of the intake pipe on Upper Fire Lake and/or the adjustment of the discharge rate of water through the bypass valve maintained hatching and rearing water temperatures throughout the winter and summer months. From July through October 50 gallons per minute of water was supplied to the wooden rearing tanks.

TABLE 4. - Fire Lake Hatchery Water Temperatures February 1, 1964 to January 31, 1965

<u>Month</u>	<u>Water Temperature ° F.</u>		
	<u>Maximum</u>	<u>Minimum</u>	<u>Mean</u>
February	38	36	37
March	39	36	37.5
April	41	36	38.5
May	45	36	40.5
June	57	44	50
July	64	50	57.5
August	60	51	55.5
September	No recordings taken. Hatchery dismantled.		
October	40	36	38
November	38	36	37
December	39	37	38
January	39	37	38

There was little difference in dissolved oxygen between the head and foot of the troughs during 1964. The lowest dissolved oxygen reading in the hatchery troughs was 4.3 ppm in late April 1964 (Table 5). In the spring, aluminum aerators were

installed at the head of the troughs. Tests revealed that the aerators increased the dissolved oxygen in the troughs approximately 2 ppm and decreased the dissolved nitrogen to a safe level.

The pH readings did not vary significantly between the head and foot of the troughs during the year (Table 5). Maximum pH readings of 7.9 occurred during August and September, while minimum readings of 6.6 occurred in April and May.

The concentrations of carbon dioxide entering the hatchery troughs ranged from 0 to 16 ppm in 1964 (Table 5).

TABLE 5. - Fire Lake Hatchery Water Analysis February 1, 1964 to January 31, 1965

Date	Water Temp. ° F.	Air ° F.*	Dissolved Oxygen	Carbon Dioxide	pH	Alkalinity
Feb. 11	37	2	6.4	4	6.9	78
Feb. 25	38	34	5.7	4	6.8	76
Mar. 6	37	30	4.4	4	6.7	76
Mar. 27	37	35	6.0	5	6.7	-
Apr. 7	38	39	5.5	6	6.7	78
Apr. 28	38	38	4.3	4	6.6	79
May 7	42	48	5.6	5	6.6	78
Aug. 14	57	66	10.8	0.0	7.9	65
Sept. 4	55	55	10.6	0.0	7.9	70
Oct. 1	42	40	11.0	16.0	7.0	80
Nov. 1	40	38	-	-	-	-
Dec. 15	38	10	10.6	15.0	7.0	78
Jan. 31	38	10	6.9	-	-	-

\* Outside air temperature

Water flow measurements were made and recorded periodically at the outlet to the hatchery. The pipe is located about 90 feet above the hatchery building and supplied water to the four wooden rearing tanks during the summer months. The water flow through the bypass pipe ranges from 40 to 100 gallons per minute. Water flowing through the hatchery varies with the number of fish during the year. An average flow of 400 gallons per minute is used in the hatchery during May, June, July and August to meet the demands of fish being raised at that time. This amount drops off to approximately 20 gallons per minute during the incubation of coho salmon eggs from October through January.

Prepared by:

Jeremy C. Sexsmith  
Fishery Biologist

Frank A. Stefanich  
Fishery Biologist

Date: March 1, 1965

Approved by:

s/ Louis S. Bandirola  
D-J Coordinator

s/ Alex H. McRea, Director  
Sport Fish Division